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EXAMINER	
THOMPSON, JAMES A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/007,440	Applicant(s) CROUNSE, KENNETH R.	
	Examiner James A. Thompson	Art Unit 2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) _____ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-10,12-19 and 21-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/1/2002,5/1/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The declaration filed on 01 May 2006 under 37 CFR 1.131 has been considered but is ineffective to overcome the Russell (US Patent Application Publication 2003/0048477 A1) reference.

The evidence submitted is insufficient to establish a conception of the invention prior to the effective date of the Russell reference. While conception is the mental part of the inventive act, it must be capable of proof, such as by demonstrative evidence or by a complete disclosure to another. Conception is more than a vague idea of how to solve a problem. The requisite means themselves and their interaction must also be comprehended. See *Mergenthaler v. Scudder*, 1897 C.D. 724, 81 O.G. 1417 (D.C. Cir. 1897).

The Russell reference is used to teach the limitations specifically recited in claim 44, and is the only reference that could potentially be overcome by Applicant's declaration under 37 CFR 1.131. Russell is not used to teach any limitations of any other claims. While Applicant's declaration does show designing dot dither order for two screens simultaneously and combining the two results to produce a best choice [see Draft 1.0, page 3, last paragraph], Applicant's declaration does not demonstrate conception of the invention as specified in claim 44, particularly with respect to the limitation that the first plurality of microdots and the second plurality of microdots is the same plurality of microdots.

Response to Arguments

2. Applicant's arguments, see page 13, lines 10-13, filed 01 May 2006, with respect to the rejections under 35 USC §112, 2nd paragraph have been fully considered and are persuasive. The rejections under 35 USC §112, 2nd paragraph listed in items 2-3 of the previous office action, dated 08 November 2005 and 15 November 2005, has been withdrawn.

3. Applicant's arguments filed 01 May 2006 have been fully considered but they are not persuasive.

Regarding page 13, line 15 to page 14, line 9: Applicant's arguments are with respect to the present amendments to claims 1, 10 and 19. As such new grounds of rejection, necessitated by the present amendments, are set forth below which demonstrate that the presently claimed invention is taught by the prior art.

Regarding page 14, line 12 to page 16, line 16: The distance function taught by Shimazaki (US Patent 5,832,122) is used for each pixel point and the surrounding pixels (column 4, lines 60 to column 5, line 3 of Shimazaki). The distance function is used to determine the minimum distance value for each pixel point (Rmin(i)) (column 4, lines 60 to column 5, line 3 of Shimazaki). The individual distance function is not in and of itself an aggregate distance function. Rather, the function used to determine Rmin(i), which is a collection of distance functions for the distances between each pixel point and the surrounding pixel, is the aggregate distance function. Furthermore, Applicant's arguments regarding a sum of inverse distances are related to the particularly disclosed embodiments set forth in the specification, and are not found in the recited claims. Applicant is respectfully reminded that, although the claims are

interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Regarding page 16, line 18 to page 19, line 8: Examiner has fully considered Applicant's Information Disclosure Statements and included both Information Disclosure Statements with the present office action.

Regarding page 19, lines 9-17: The present claims are demonstrated to be taught by the prior art, both above and in the prior art rejections below. The new grounds of rejection set forth below have been necessitated by the present amendments to the claims.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1, 5-10, 14-19 and 23-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Woods (US Patent 6,833,933 B1).**

Regarding claims 1, 10 and 19: Shimazaki discloses a screening system (figure 1 of Shimazaki) comprising means (figure 1(10,22) of Shimazaki) for generating, retrieving or storing a screen suited for the transformation of a continuous tone image into a halftone image, wherein said screen comprises

a plurality of discrete spotlike zones generated by using threshold values in a threshold matrix (figure 5 and column 4, lines 6-10 of Shimazaki), the threshold matrix produced by (a) providing a base supercell suitable for periodically tiling a plane (figure 5 and column 4, lines 46-51 of Shimazaki), the base supercell comprising a plurality of virtual halftone dot centers, each of said halftone dot centers being surrounded by a cluster of associated microdots (figure 5(1,2); column 4, lines 36-41; and column 5, lines 16-24 of Shimazaki); (b) assigning an ordering sequence comprising a series of numbers on the virtual halftone dot centers in the base supercell (column 4, lines 36-45 of Shimazaki) by (i) assigning a first number in the ordering sequence to a first virtual halftone dot center in the base supercell (figure 5(1) and column 4, lines 55-59 of Shimazaki); (ii) assigning a second consecutive number in the ordering sequence to a second virtual halftone dot center in the base supercell (figure 5(2) and column 4, lines 55-59 of Shimazaki); (iii) calculating a value of an aggregate distance function (figure 4(S166) and column 5, lines 9-17 of Shimazaki) for each virtual halftone dot center in the base supercell not already included in the ordering sequence (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (iv) selecting a next virtual halftone dot center in the base supercell in response to the calculated aggregate distance function, the next virtual halftone dot center having one of the least values of the calculated aggregate distance function (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (v) assigning the next consecutive number in the ordering sequence to the selected next virtual halftone dot center in the base supercell (figure 7; and column 5, lines 61-67 of Shimazaki); and (vi) repeating

steps (iii), (iv) and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence (figure 4 and column 6, lines 1-4 of Shimazaki); (c) assigning threshold values to said associated microdots surrounding said halftone dot centers in response to the ordering sequence thereby generating the threshold matrix in the base supercell (figure 7 and column 6, lines 1-8 of Shimazaki); and (d) using the threshold matrix in combination with the contone image to generate a screened halftone image on the recording medium (column 4, lines 4-13 of Shimazaki).

Shimazaki further discloses that the aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power (figure 4 (S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki does not disclose expressly that said distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power (column 4, lines 17-20 of Woods). The distance function ($D=\frac{R-D'}{D'}$ where $D'=\sqrt[1.55]{D_{\max}^{1.55}+\min\left(D_{\max}-0.1D_{\min},D_{mec}\right)^{1.55}}$ and

$R = \sqrt{\frac{30}{\pi\left(\frac{(N/2)-abs(t-(N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the system of Shimazaki. Thus, said distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claims 1, 10 and 19.

Further regarding claim 10: The system of claim 19 creates the screen of claim 10.

Further regarding claim 1: The method of claim 1 is performed by the system of claim 19.

Regarding claims 5, 14 and 23: Shimazaki discloses that the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5 (1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). As can be seen from figure 5 of Shimazaki, the second virtual halftone dot center in the base (center) supercell is three blocks to the right and two blocks up from the first virtual halftone dot center, but is three blocks to the right and *three* blocks down from the first virtual halftone dot center of the above adjacent supercell. Thus, the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in the supercells immediately above the base supercell. Furthermore, by similar analysis, said second virtual halftone dot center is clearly disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in all the other supercells adjacent to the base supercell.

Regarding claims 6, 15 and 24: Shimazaki discloses that the distance between the second virtual halftone dot center (figure 5(2) of Shimazaki) and the first virtual halftone dot center (figure 5(1) of Shimazaki) is not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell (figure 5 of Shimazaki). As can clearly be seen from figure 5 of Shimazaki, the distance between the second virtual halftone dot center and

the first virtual halftone dot center in the base (center) supercell is different than the distance between the second virtual halftone dot center in the base supercell and the first virtual halftone dot center in all of the adjacent supercells.

Regarding claims 7, 16 and 25: Shimazaki discloses that the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5(1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). The periodically replicated supercells shown in figure 5 of Shimazaki are merely exemplary. Using particular differently-sized base supercell in the system taught by Shimazaki will cause the second virtual halftone dot center to be disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

Regarding claims 8, 17 and 26: Shimazaki discloses that the plurality of virtual halftone dot centers (figure 7(1,2,3A, 3B,23A,23B,24,25) of Shimazaki) in the base supercell is arranged on a periodic grid having a screen angle and a screen ruling (figure 7 of Shimazaki). As can clearly be seen in figure 7 of Shimazaki, the virtual halftone dot centers are set in an evenly-spaced rectangular grid with a screen angle of zero.

Regarding claims 9, 18 and 27: Shimazaki discloses, after step (c) and prior to step (d), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image (column 6, lines 43-49 of Shimazaki).

6. Claims 3-4, 12-13 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Woods (US Patent 6,833,933 B1) and obvious engineering design choice.

Regarding claims 3, 12 and 21: Shimazaki does not disclose expressly that the positive power is 1.5.

Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods).

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations (column 3, lines 17-27 of Woods), raised to a positive power (column 4, lines 17-20 of Woods), wherein said aggregate function can be one of many possible functions (column 4, lines 6-8 of Woods), as taught by Woods in the distribution of threshold values, and thus dot orders, in the system of Shimazaki. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki.

While Shimazaki in view of Woods does not disclose expressly that the positive power is 1.5, it would have been an obvious engineering design choice to select the positive power as 1.5. A value of 1.5 for the positive power would cause the value of the inverse distance function to dissipate, but not rapidly. Furthermore, 1.5 is close to the value of the power that inverse distance is raised to when determining Coulomb

forces, which is relied upon in the placement of toner particles in halftone image transference.

Regarding claims 4, 13 and 22: Shimazaki does not disclose expressly that the positive power is 2.0.

Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods).

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations (column 3, lines 17-27 of Woods), raised to a positive power (column 4, lines 17-20 of Woods), wherein said aggregate function can be one of many possible functions (column 4, lines 6-8 of Woods), as taught by Woods in the distribution of threshold values, and thus dot orders, in the system of Shimazaki. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki.

While Shimazaki in view of Woods does not disclose expressly that the positive power is 2.0, it would have been an obvious engineering design choice to select the positive power as 2.0. A value of 2.0 for the positive power would cause the value of the inverse distance function to dissipate, but not rapidly. Furthermore, 2.0 is the value of the power that the inverse distance is raised to when determining Coulomb forces, which is relied upon in the placement of toner particles in halftone image transference.

7. Claims 28, 37-41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065).

Regarding claim 28: Shimazaki discloses a method for reproducing a contone image as a halftone image on a recording medium, using threshold values in threshold matrices (figure 5 and column 4, lines 6-10 of Shimazaki), comprising the steps of (a) providing a first base supercell suitable for periodically tiling a plane (figure 5 and column 4, lines 46-51 of Shimazaki), the first base supercell comprising a plurality of virtual halftone dot centers being surrounded by a cluster of associated microdots (figure 5(1,2); column 4, lines 36-41; and column 5, lines 16-24 of Shimazaki); (c) assigning a first ordering sequence in the first base supercell, the first ordering sequence comprising a series of numbers (column 4, lines 36-45 of Shimazaki) by (i) assigning a first number in the first ordering sequence to a first virtual halftone dot center in the first base supercell (figure 5(1) and column 4, lines 55-59 of Shimazaki); (iii) calculating a value of a combined aggregate distance function (figure 4(S166) and column 5, lines 9-17 of Shimazaki) for each virtual halftone dot center from a first plurality of virtual halftone dot centers (figure 5(1,2) of Shimazaki) in the first base supercell not already included in the first ordering sequence (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (iv) selecting a first next virtual halftone dot center in the first base supercell in response to the value of the combined calculated aggregate distance function calculated in step (iii), the first next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function (figure 3

and column 4, line 60 to column 5, line 3 of Shimazaki); (v) assigning the next consecutive number in the first ordering sequence to the selected first next virtual halftone dot center in the first base supercell (figure 7; and column 5, lines 61-67 of Shimazaki); and (ix) repeating steps (iii), (iv) and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence (figure 4 and column 6, lines 1-4 of Shimazaki); (d) assigning threshold values to said associated microdots surrounding said halftone dot centers in response to the first ordering sequence thereby generating the first threshold matrix in the first base supercell (figure 7 and column 6, lines 5-8 of Shimazaki); and (f) using the first threshold matrix in combination with the first color separation to generate a screened halftone image on the recording medium (column 4, lines 4-13 of Shimazaki).

Shimazaki does not disclose expressly that said halftone image is a multi-color halftone image having color separations; (b) providing a second base supercell suitable for periodically tiling a plane, the second base supercell comprising a plurality of virtual halftone dot centers being surrounded by a cluster of associated microdots; (c) assigning a second ordering sequence to the virtual halftone dot centers in the second base super-cell, the second ordering sequence comprising series of numbers by (ii) assigning a first number in the second ordering sequence to a first virtual halftone dot center in the second base super-cell; (vi) calculating a value of a combined aggregate distance function for each virtual halftone dot center from a second plurality of virtual halftone dot centers in the second base supercell not already included in the second ordering sequence; (vii) selecting a second next virtual halftone dot center in the

second base supercell in response to the value of the combined aggregate distance function calculated in step (vi), the second next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function; (viii) assigning the next consecutive number in the second ordering sequence to the selected second next virtual halftone dot center in the second base supercell; (ix) repeating steps (vi)-(viii), until each virtual halftone dot center in the second base supercell is included in the second ordering sequence; (e) assigning threshold values to said associated microdots surrounding said halftone dot centers in response to the second ordering sequence thereby generating the second threshold matrix in the second base supercell; and (f) using the second threshold matrix in combination with a second color separation of said contone image to generate a screened multi-color halftone image on the recording medium.

Ulichney discloses processing a plurality of colors, wherein each color is processed separately and independently (column 9, lines 1-8 of Ulichney).

Shimazaki and Ulichney are combinable because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply the method of Shimazaki to multiple colors separations, wherein each color is processed separately and independently, as taught by Ulichney. Thus, by applying the method taught by Shimazaki to a second independent color component, the method of Shimazaki in view of Ulichney would further comprise (b) providing a second base supercell suitable for periodically tiling a plane, the second base supercell comprising a plurality of

virtual halftone dot centers being surrounded by a cluster of associated microdots; (c) assigning a second ordering sequence to the virtual halftone dot centers in the second base supercell, the second ordering sequence comprising series of numbers by (ii) assigning a first number in the second ordering sequence to a first virtual halftone dot center in the second base supercell; (vi) calculating a value of a combined aggregate distance function for each virtual halftone dot center from a second plurality of virtual halftone dot centers in the second base supercell not already included in the second ordering sequence; (vii) selecting a second next virtual halftone dot center in the second base supercell in response to the value of the combined aggregate distance function calculated in step (vi), the second next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function; (viii) assigning the next consecutive number in the second ordering sequence to the selected second next virtual halftone dot center in the second base supercell; (ix) repeating steps (vi)-(viii), until each virtual halftone dot center in the second base supercell is included in the second ordering sequence; (e) assigning threshold values to said associated microdots surrounding said halftone dot centers in response to the second ordering sequence thereby generating the second threshold matrix in the second base supercell; and (f) using the second threshold matrix in combination with a second color separation of said contone image to generate a screened multi-color halftone image on the recording medium. The suggestion for doing so would have been that the method of Shimazaki is applied to a monochromatic image, but each color component is also processed separately and independently, each color as a

monochromatic image (column 9, lines 8-15 of Ulichney). Therefore, it would have been obvious to combine Ulichney with Shimazaki to obtain the invention as specified in claim 28.

Further regarding claim 37: Shimazaki discloses, after step (i) and before step (iii), the step of assigning a second consecutive number in the first ordering sequence to a second virtual halftone dot center (figure 5(2) of Shimazaki) in the first base supercell (column 4, lines 54-59 of Shimazaki); and assigning a second consecutive number in the second ordering sequence to a second virtual halftone dot center (figure 5(2) of Shimazaki) in the second base supercell (column 4, lines 54-59 of Shimazaki). As discussed above in the arguments regarding claim 28, Shimazaki in view of Ulichney teaches multiple color components. Thus, the teachings of Shimazaki are applied separately and independently to each color component.

Further regarding claim 38: Shimazaki discloses that, in each base supercell, the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5(1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). As can be seen from figure 5 of Shimazaki, the second virtual halftone dot center in the base (center) supercell is three blocks to the right and two blocks up from the first virtual halftone dot center, but is three blocks to the right and *three* blocks down from the first virtual halftone dot center of the above adjacent supercell. Thus, the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in the supercells immediately above the base supercell. Furthermore, by similar

analysis, said second virtual halftone dot center is clearly disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in all the other supercells adjacent to the base supercell.

Regarding claim 39: Shimazaki discloses that, in each supercell, the distance between the second virtual halftone dot center (figure 5(2) of Shimazaki) and the first virtual halftone dot center (figure 5(1) of Shimazaki) is not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell (figure 5 of Shimazaki). As can clearly be seen from figure 5 of Shimazaki, the distance between the second virtual halftone dot center and the first virtual halftone dot center in the base (center) supercell is different than the distance between the second virtual halftone dot center in the base supercell and the first virtual halftone dot center in all of the adjacent supercells.

Further regarding claim 40: Shimazaki discloses that, in each base supercell, the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5 (1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). The periodically replicated supercells shown in figure 5 of Shimazaki are merely exemplary. Using particular differently-sized base supercell in the system taught by Shimazaki will cause the second virtual halftone dot center to be disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

Further regarding claim 41: Shimazaki discloses that the first plurality of virtual halftone dot centers (figure 7(1,2, 3A,3B,23A,23B,24,25) of Shimazaki) is arranged on a periodic grid having a first screen angle and a screen ruling (figure 7 of Shimazaki). As can clearly be seen in figure 7 of Shimazaki, the virtual halftone dot centers are set in an evenly-spaced rectangular grid with a screen angle of zero.

Further regarding claim 43: Shimazaki discloses, after step (e), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image (column 6, lines 43-49 of Shimazaki).

8. Claims 29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065) and Woods (US Patent 6,833,933 B1).

Further regarding claim 29: As discussed in the arguments regarding claim 28, Shimazaki combined with Ulichney teaches a first base supercell and a second base supercell. Shimazaki in view of Ulichney discloses that the first component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki); and the second component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence,

with each of the distances raised to a positive power (figure 4 (S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki in view of Ulichney does not disclose expressly that said first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power (column 4, lines 17-20 of Woods). The distance function ($D = \frac{R - D'}{D'}$ where $D' = \sqrt[1.55]{D_{\max}^{1.55} + \min\left(D_{\max} - 0.1D_{\min}, D_{mec}\right)^{1.55}}$ and $R = \sqrt{\frac{30}{\pi\left(\frac{(N/2) - abs(t - (N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki in view of Ulichney is combinable with Woods because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for half-tone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the method of Shimazaki. Thus, said first component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claim 29.

Further regarding claim 32: As discussed in the arguments regarding claim 28, Shimazaki combined with Ulichney teaches a first base supercell and a second base supercell. Shimazaki in view of Ulichney discloses that the first component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3

of Shimazaki); and the second component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki in view of Ulichney does not disclose expressly that said first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power (column 4, lines 17-20 of Woods). The distance function

($D = \frac{R - D'}{D'}$ where $D' = \sqrt[1.55]{D_{\max}^{1.55} + \min\left(D_{\max} - 0.1D_{\min}, D_{mec}\right)^{1.55}}$ and

$R = \sqrt{\frac{30}{\pi\left(\frac{(N/2) - abs(t - (N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots

is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki in view of Ulichney is combinable with Woods because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for half-tone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the method of Shimazaki. Thus, said first component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claim 32.

9. Claims 30-31 and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065), Woods (US Patent 6,833,933 B1) and obvious engineering design choice.

Further regarding claims 30-31: Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods). It would have been an obvious engineering design choice to select the positive power of the first component aggregate distance function to be less than zero, and particularly 0.5.

Further regarding claims 33-34: Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods). It would have been an obvious engineering design choice to select the positive power of the second component aggregate distance function to be less than zero, and particularly 0.5.

10. Claims 35-36 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065) and Roberts (US Patent 3,742,129).

Further regarding claim 35: Shimazaki in view of Ulichney does not disclose expressly that the first virtual halftone dot center in the second base supercell is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the first base supercell.

Roberts discloses that the halftone screens of the different halftone primary colors are generated at different screen angles (figure 6; and column 4, lines 20-23, lines 27-30 and lines 40-42 of Roberts).

Shimazaki in view of Ulichney is combinable with Roberts because they are from the same field of endeavor, namely half-toning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to generate the first base supercell and second base supercell at different screen angles and replicate said first base supercell and said second base supercell at different screen angles. Thus, the first virtual halftone dot center in the second base supercell would be disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the first base supercell. The motivation for doing so would have been to reduce printing artifact, such as Moiré, that occur in color halftone printing (column 4, lines 28-34 of Roberts). Therefore, it would have been obvious to combine Roberts with Shimazaki in view of Ulichney to obtain the invention as specified in claim 35.

Further regarding claim 36: The halftone screens of each different halftone color are generated at different angles and the first and second base supercells are replicated at different angles, as discussed in the arguments regarding claim 35. Therefore, the distance between the first virtual halftone dot center in the first base supercell and the first virtual halftone dot in the second base supercell is not equal to the distance between the first virtual halftone dot center in the second base supercell and the periodic replication of the first virtual halftone dot center of the first base supercell in any supercells directly adjacent to the first base supercell.

Further regarding claim 42: Shimazaki in view of Ulichney does not disclose expressly that the second plurality of virtual

halftone dot centers is arranged on a periodic grid having a second screen angle and a screen ruling.

Roberts discloses that the halftone screens of the different halftone primary colors are generated at different screen angles (figure 6; and column 4, lines 20-23, lines 27-30 and lines 40-42 of Roberts). Given a regular rectangular grid, the different screen angle taught by Roberts also result in different screen rulings at the respective angles of the different colors.

Shimazaki in view of Ulichney is combinable with Roberts because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to generate the first base supercell and second base supercell at different screen angles and rulings. Thus, the second plurality of virtual halftone dot centers would be arranged on a periodic grid having a second screen angle and a screen ruling. The motivation for doing so would have been to reduce printing artifact, such as Moiré, that occur in color halftone printing (column 4, lines 28-34 of Roberts). Therefore, it would have been obvious to combine Roberts with Shimazaki in view of Ulichney to obtain the invention as specified in claim 42.

11. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065) and Russell (US Patent Application Publication 2003/0048477 A1).

Regarding claim 44: Shimazaki in view of Ulichney does not disclose expressly that the first plurality of microdots and the

second plurality of microdots is the same plurality of microdots.

Russell discloses establishing dots of different types and frequencies in the same halftone screen (figures 4a-4h and paragraph 39 of Russell).

Shimazaki in view of Ulichney is combinable with Russell because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the multiple halftone screens taught by Shimazaki in view of Ulichney into a single halftone screen, as taught by Russell. The motivation for doing so would have been to provide for smooth tonal transitions (paragraph 10, lines 4-11 of Russell). Therefore, it would have been obvious to combine Russell with Shimazaki in view of Ulichney to obtain the invention as specified in claim 44.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

05 July 2006

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